

# Lasers in Pediatric dentistry

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Existence of pediatric dentistry is related to dental and Orofacial problems of children. Old dental school and institution had a different concept in treating children. Till 1950, dental treatment for children below 13 years was avoided or neglected in Europe and United states. Later, American Academy of pediatric dentistry and American Society of dentistry for children recommended the routine dental check up by 1<sup>st</sup> year of age.

Pediatric dentistry has come through phase of various diagnostic procedures for child diseases, various restorative procedures with advanced materials, pulp therapy, Prosthesis for rehabilitation and to replace masticatory functions, space maintenance and interceptive orthodontics. Today, pediatric dentistry is focused on prevention and preventive procedures. As saying goes, "**Prevention is better than Cure**". Prevention of dental diseases is primary focus for dental treatment in children nowadays.

Treating infants and children is a rewarding experience. Current trend and technology makes dental professionals to think about the preventive procedures beyond caries management and develop a concept with latest advancement taking places in the field of dentistry.

Traditionally, dental treatment has been carried out with the high speed airtor handpiece which has its own drawbacks like vibrations, smell and noise which makes child very apprehensive and makes pediatric patients anxious and fearful. All these procedures require need of anesthetic solutions.

As technology continued to advance, field of dentistry has come across phase of high technology with various advancement like air abrasion, advancement in restorative materials with nanotechnology, advancement in radiographic equipments like RVG and amongst latest one is use of **DENTAL LASER**.

Use of dental laser technology allows clinician to perform micro dentistry, removing only diseased part of dental tissue and to preserve healthy tooth structure. Dental laser is gaining acceptance and popularity over conventional approach for many dental procedures due to elimination of need of anesthesia, lack of noise and hence no fear of pain due to needle pricks. Soft tissue procedures which were rejected once due to need of anesthesia can be safely performed with lasers in dental office.

Irrespective to various wavelengths of laser, it offers certain benefits to dentistry. Because lasers seal blood vessels, they offer a dry operating field and excellent visibility, helps reducing operation time especially in pediatric patients, and also seals lymphatic vessels. Laser reduces pain or makes procedures painless in 90% of cases by sealing nerve fibers, which makes it special for pediatric patients. Sutures are rarely needed in laser therapy.

Since then, lasers have been reviewed and experimented by many but actual use of lasers in dentistry was in 1990's after Terry Mayer's experimental study on Nd: YAG laser. Advanced research has helped laser to be used in various diagnostic procedures. In clinical procedures, application of lasers has been extended in to pediatric dentistry. Many different lasers are useful in pediatric dentistry. In pediatric dentistry it is used for diagnosing dental caries, soft tissue procedures like tongue tie, for treatment of maxillary frenum in infants and in mixed dentition, for exposures of teeth in orthodontic treatment and for many other procedures.

With the development and introduction of Erbium family of lasers, the pediatric dentist has a safe and efficient laser available for clinical practice. Hard tissue procedures with erbium lasers are carried out with non-contact mode and water spray. Soft tissue procedures are carried out with or without water spray and mostly in both contact and noncontact mode. Again, erbium family of lasers have one more benefits like bactericidal effects by sterilizing the area, numbing or analgesic effect on target tissue which are similar to Nd: YAG laser device.

## **Laser procedures for soft tissue:**

### ➤ **Treatment for ankyloglossia:**

Ankyloglossia is a relatively common finding in the newborn population and represents a significant proportion of breast-feeding problems.

While treating infants for abnormal frenum, certain points need to remember:

- a) Lingual attachment should not create a diastema between lower anterior teeth

- b) Lingual attachment should not cause excessive pressure on lower anterior teeth
- c) Lingual attachment should not cause the severe blanching of the gum tissue behind the lower anterior teeth.
- d) The lingual attachment should not prevent a normal swallowing pattern. The tongue should be able to lick the lips, touch the roof of the mouth and allow normal cleansing of the tooth surfaces

For tongue tie revision in neonates, Er: YAG laser wavelength could be preferred without sedation or local anesthetic. This could be beneficial from clinician point of view as there is minimal discomfort and elimination of needle pain will help in patient co operation and will be appreciated by parents.

Laser settings are Er: YAG 30 hz, 50mj, without water or Er, Cr: YSGG 20 hz, 1 watt without water. Eye goggles should be worn as safety measures.

Normally, 8 mm of freedom is adequate for normal nursing. After completion of treatment, children can begin nursing and nursing mothers can have immediate relief of pain and improved infant sleep duration.

#### **Procedure for ankyloglossia by laser treatment:**

Er: YAG 30 hz, 50mj, or Er, Cr: YSGG 20 hz, 1 watt without water, laser wavelengths are set. For older children and adults, use of local anesthesia can be of operator's choice.

- The tongue is stabilized with hemostat and the frenum is revised.
  - If the frenum is fibrous, it can be cut by grasping the tip of the tongue for stabilization. If the frenum is more closely attached, the hemostat is placed close to the underside of the tongue.
  - Laser tip is moved slowly down the hemostat until the revision is completed.
  - A suture can be placed at the junction of the frenum and at the end of the cut to prevent reattachment.
- Allow the surgical site for healing which is normally uneventful and satisfactory.

#### ➤ **Diagnosis and treatment for maxillary frenum in infants and in mixed dentition:**

Normally In infants, high maxillary frenum attachment is noted inserting into the alveolar ridge and in severe cases, extending between the central incisors inserting into the palate. This can lead to diastema in anterior region between central incisors and may cause the lip to get caught between the central incisors, and interfere with adequate oral hygiene.

**In mixed dentition**, in addition to soft tissue-revision, the procedure may require the lasing of bone between the two maxillary central incisors. In that case, the erbium lasers are an ideal choice of instrument, and water spray must be used.

According to **Kotlow L A** (2004), the optimal time to revise the frenum, if it is not treated in the early primary dentition, is when the two central incisors have erupted about 2 to 3 mm. Afterward, the eruption of the lateral incisors help in closing the diastema once the frenum tissue is ablated. There is no adverse scar formation from this procedure, and it can be completed before initiation of orthodontics. If the diastema is the only problem, orthodontics may not be required. Other wavelengths like Nd: YAG laser (1064nm) can be used with a setting of 100 hz, 20mj, 2 watts for the ablation of the soft tissue.

#### **Exposure of teeth for orthodontic treatment:**

Different types of wavelengths of laser could be used to expose the tooth but the most effective one is Erbium laser. No need of local anesthesia when only soft tissue requires to be removed. Laser settings recommended by **Kotlow L A** (2004) are Er: YAG 30 hz, 45 mj; Er, Cr: YSGG 20 hz, 70 mj; both in contact and noncontact mode.

When using the erbium instruments, care must always be taken when near enamel to prevent etching as Erbium laser has high affinity towards the hydroxyapatite crystals of enamel.

Therefore, as the enamel is exposed the laser tip must be held parallel to the surface of the tooth. While using the Nd: YAG or diode laser for this procedure, there is no danger of etching or injuring the enamel because the wavelength of these lasers does not interact with tooth structure.

#### ➤ **Gingival recontouring and gingivectomies in orthodontic patients:**

**Guelman et al.**, (2003) suggested that in case of gingival hyperplasia or gingival enlargement induced by medicaments like dilantin sodium, laser treatment could be carried out to reshape gingiva.

Lasers can remove the gingival tissue to allow placement of a restoration without concerns for bleeding. Most of these procedures can be completed without local anesthesia and with little or no postoperative discomfort. Different laser instruments can be used like Erbium lasers with 20 to 30 hz and 55 to 80 mj, without water spray.

Erbium lasers help in removing hyperplastic tissues present during orthodontic treatment. An argon laser (514 nm) may also be used with a setting of 1 watt, continuous wave for soft tissue removal.

➤ ***For pericoronal flap problems associated with erupting tooth:***

Many times, children with erupting tooth or recently erupted tooth, complain of discomfort, swelling, or infection in the tissue overlying erupting/erupted tooth.

Lasers can be used in a noncontact mode to ablate the involved tissue and expose the clinical crown of the involved tooth. In most instances the treatment with the laser can be completed without the use of local anesthesia. **Kotlow L A** (2004) suggested Erbium laser with settings of 20–30 hz and 45 to 55 mj in a noncontact mode without water.

***For treatment of aphthous ulcers and herpetic lesions:***

Laser treatment for aphthous ulcer or recurrent aphthous ulcer is one of the easiest and rewarding procedures, which has been recommended by **Parkins et al.**, (1994).

**Kotlow L A** (2004) suggested low power settings, and stated that laser energy should be directed at the target tissue in a noncontact fashion.

According to him, diode instrument could be set at 0.4 watts, continuous; Nd: YAG could be used at 20 hz, 50 mj; and Erbium lasers can be used at minimum hz with 30 to 40 mj. The involved area is lased in 15- to 30-second intervals, no local anesthesia is used, and the procedure is repeated three or four times until the patient reports relief.

The tissue may appear drier at the end of the treatment, without much change in color. High speed suction should be used because the vaporized plume may contain infective tissue fragments.

***For pulp therapy in primary teeth:***

Traditionally, root canal medicaments like formocresol have been used in pulp therapy of primary and permanent teeth.

**Kotlow L A** (2004) treated more than 150 teeth over the period of 2 years and found that use of Erbium laser gives equal to or better results than with conventional formocresol.

According to him, in vital teeth, the laser could be set at 20 to 30 hz, 50 to 70 mj, can clean the pulp chamber in 10 to 20 seconds. He concluded that it provides sufficient hemostasis and leaves some vital tissue at apex. In nonvital teeth, the laser's success rates seem equal to conventional pulpotomy procedures. If a fistula is present, the same settings are used to incise it, but the success rate decreases significantly.

**Laser procedures for hard tissue:**

Laser is effective against hard tissue of tooth in removal of caries and is believed to be safe procedure. **White J M et al.**, (1993) recommended Nd: YAG laser wavelength for removal of superficial pigmented caries. The Erbium family of lasers is the choice of laser and is most efficient and safe for deep enamel, dentin and caries removal.

**Hadley J et al.**, (2000) observed in their study that Er, Cr:YSGG laser system is effective for preparation of class I, III, and V cavities and resin restorations are retained by lased tooth surface.

**Kotlow L A** (2004) stated that laser treatment prevents micro-fractures which appear normally after conventional drill. Normally, local anesthesia is not required. He reviewed that Erbium laser can remove caries successfully. He observed that the key factor is to use the lowest power setting possible to carryout successful result. Increased power does not assure better treatment. The laser's ability to remove hard tissue depends on such factors as the water and fluoride content of the target tissue; the laser settings, including energy, pulses per second, and water spray pattern; the tip material, shape, and diameter; and the proper suctioning technique to remove the water and ablated particles.

During laser treatment, proper isolation is must which is achieved by using rubber dam. A clamp should be kept gently on gingival tissue but not sub gingivally, local anesthesia is not required.

***For removal of amalgam and other restorations:***

**Kotlow L A** (2004) does not recommend laser system to remove faulty amalgam restorations but can be used to remove secondary caries under amalgam restorations. If caries ablation requires removal of existing amalgam restoration, laser tip should be directed at the surrounding enamel to produce a small trough. Metal can be removed with hand instrument. Defective composite and glass ionomer cements can be removed with laser.

***For sealant placement:***

Use of sealants in children has been neglected by many since its introduction in 1955.

**Feigal R** (2002) stated that nearly 70% of molars develop occlusal surface caries within 3 years of the tooth's eruption. The laser allows the dentist to clean, sterilize, and clearly visualize the enamel grooves. Enamel shows different types of patterns after etching. Studies done by **Visuri S R et al.**, (1996) showed that the erbium etched enamel has similar properties to acid etched enamel.

**Kotlow L A** (2004) confirmed that water is essential while removing etched tooth and caries. Laser tip should be moved around pits and fissures to avoid inuring the tooth being etched. After this, placement of sealants and additional acid conditioning can be carried out.

***For caries removal and tooth preparation:***

**Kotlow L A** (2004) recommended the erbium laser caries removal and stated that it removes caries efficiently. In case of fluorosis, ablation process may proceed slowly due to minimal water content. Here, high speed turbine may be used. He demonstrated that the laser tip should be perpendicular to tooth surface for better cutting efficiency and once enamel is removed, energy should be reduced for dentin and carious lesion as they have more water content than enamel and can be cut easily.

**Kotlow L A** (2004) recommended settings for erbium family of lasers with total power of 6 watts for enamel removal, 4 watts for dentin preparation and 2 watts for caries removal with water spray. After ablation of tissue, slow speed handpiece can be used for removal of deep caries if required. He recommended use of matrices for class II caries for adjacent tooth to prevent accidental etching of the enamel surface on the noncarious adjacent tooth.

Apart from above mentioned procedures, laser could be used for combine soft and hard tissue procedures. Apicoectomies and removal of impacted teeth under bone could be carried out with Erbium laser with different laser tips, settings and with water spray which has been observed in study done by **Sasaki K et al.**, (2002).

According to **Kotlow L A** (2004), for such a procedure, initial setting could be 20 to 30 hz, 50 to 60 mj, no water for soft tissue ablation, followed by the removal of underlying bone using 20 to 30 hz, 80 to 100 mj with water, and then the sectioning of the impacted tooth with high power (6 watts). He recommended use of sterile water as a water supply during laser surgery.

Hence, lasers provide preventive, interceptive and restorative treatment for children with better cooperation and appreciation of parents. Lasers help the dentist to provide children with minimally invasive dentistry for hard- and soft-tissue procedures with minimal discomfort, no pain during and after treatment, no injections, and little or no bleeding. Parents and children appreciate the elimination of needles, vibrations, and the smell of conventional dental care. Lasers may lead to phenomenal change in dentistry in coming future to replace conventional dental handpiece in dental clinic.

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